

Single exosome detection in serum using microtoroid optical resonators (Conference Presentation)

Judith Su, California Institute of Technology (United States)

ABSTRACT

Recently exosomes have attracted interest due to their potential as cancer biomarkers. We report the real time, label-free sensing of single exosomes in serum using microtoroid optical resonators. We use this approach to assay the progression of tumors implanted in mice by specifically detecting low concentrations of tumor-derived exosomes. Our approach measures the adsorption of individual exosomes onto a functionalized silica microtoroid by tracking changes in the optical resonant frequency of the microtoroid. When exosomes land on the microtoroid, they perturb its refractive index in the evanescent field and thus shift its resonance frequency. Through digital frequency locking, we are able to rapidly track these shifts with accuracies of better than 10 attometers (one part in 10^{11}). Samples taken from tumor-implanted mice from later weeks generated larger frequency shifts than those from earlier weeks. Control samples taken from a mouse with no tumor generated no such increase in signal between subsequent weeks. Analysis of shifts from tumor-implanted mouse samples show a distribution of unitary steps, with the maximum step having a height of ~ 1.2 fm, corresponding to an exosome size of 44 ± 4.8 nm. This size range corresponds to that found by performing nanoparticle tracking analysis on the same samples. Our results demonstrate development towards a minimally-invasive tumor "biopsy" that eliminates the need to find and access a tumor.

View presentation recording on the SPIE Digital Library:
<http://dx.doi.org/10.1117/12.2214055.4848770198001>